DOCUMENT RESUME

ED 193 560 CG 014 721

AUTHOR Glynn, Shawn M.
TITLE Organizational Cues and Long-Term Elaborative Recall of Text.
PUB DATE Sep 80
NOTE 27p.: Paper presented at the Annual Convention of the American Psychological Association (88th, Montreal, Quebec, Canada, September 1-5, 1980).

EDRS PRICE MF01/PC02 Plus Postage.
DESCRIPTORS *Advance Organizers: Association (Psychology): Cognitive Processes: *Comprehension: *Cues; *Learning Processes: Learning Theories: Memorization; Organization: *Recall (Psychology): *Retention (Psychology): Rote Learning
IDENTIFIERS *Encoding (Psychological)

ABSTRACT

The comprehension and recall of instructional text is heavily dependent upon the contexts in which information input and retrieval occur. College students (N=44) recalled the contents of a hierarchically structured text immediately after study and again six weeks later. Total meaningful recall was better when the superordinate concepts, or cues, activated prior to study were relevant rather than irrelevant to the content of the text. Total meaningful recall was best, however, when the relevant assimilatory cues were reinstated at the time of retrieval. These findings were generally consistent with the principle of encoding specificity. Clustering analyses of the ideational patterns that were present in recall protocols supported the view that organization was the mechanism underlying cue effects. Additional analyses indicated that the availability of cues at retrieval stimulated the importation (elaboration) of test-relevant ideas. This effect was most pronounced during long-term recall. Findings suggest that organizational activity can prompt appropriate transactions between what learners already know and what they are setting out to learn. (Author)

Organizational Cues and Long-term Elaborative Recall of Text

Shawn M. Glynn

University of Georgia

Paper presented at the meeting of the American Psychological Association, Montreal, September 1980.

Send correspondence to: Shawn M. Glynn

Department of Educational Psychology

325 Aderhold Hall

University of Georgia

Athens, GA 30602

Abstract

College students recalled the contents of a hierarchically structured text immediately after study and again six weeks later. Total meaningful recall was better when the superordinate concepts, or cues, activated prior to study were relevant rather than irrelevant to the content of the text. Total meaningful recall was best, however, when the relevant assimilatory cues were reinstated at the time of retrieval. These findings were generally consistent with the principle of encoding specificity. Clustering analyses of the ideational patterns that were present in recall protocols supported the view that organization was the mechanism underlying cue effects. Additional analyses indicated that the availability of cues at retrieval stimulated the importati (elaboration) of text-relevant ideas -- this effect was most pronounced during long-term recall. In general, the findings suggest that organizational activity can prompt appropriate transactions between what learners already know and what they are setting out to learn.

Organizational Cues and Long-term Elaborative Recall of Text

The comprehension and recall of instructional text is heavily dependent upon the contexts in which information input and retrieval occur. If the contexts minimize the likelihood of interaction between text information and existing stores of referential knowledge, then learners will recall the transmitted information in a verbatim fashion (e.g., Gomulicki, 1956; Howe, 1970; Zangwill, 1972). However, if contextual arrangements stimulate such interaction, then extratextual extensions of meaning also may be included in recall (e.g., Anderson, Reynolds, Schallert, & Goetz, 1977; Cofer, Chmielewski, & Brockway, 1976; Dooling & Christiaansen, 1976; Spiro, 1977). Extratextual extensions of meaning refer here to reasonable embellishments or importations that occur when the content of a text engages a rich store of relevant prior knowledge. From an educational perspective, these extensions of meaning are desirable because their production indicates that the text has been processed in a meaningful rather than a rote fashion.

According to Ausubel's (1960) subsumption theory and Mayer's (1975) assimilation encoding theory, meaningful reception learning has at least two requirements: (1) the availability of a meaningful context to which new material may be assimilated, and (2) the activation of this context in advance of learning. Ideally, this context should include superordinate concepts or cues that learners can use to organize text content and integrate it with existing knowledge. In instructional settings, assimilatory contexts often are made available to learners by devices such as outlines (Frase, 1969; Glynn & Di Vesta, 1977) previews (Merrill & Stolurow, 1966), and advance organizers (Ausubel, 1960; Mayer, 1976.

In general, these organizational aids are intended to bridge the gap between what learners already know and what they are setting out to learn. In particular, they enable learners to impose hierarchical structures on material which is technical, unfamiliar, and often poorly organized (Mayer, 1978).

Empirical evidence regarding the effectiveness of organizational aids is inconsistent -- sometimes these devices have enhanced recall and sometimes they have had little or no effect (for detailed reviews, see Hartley & Davies, 1976; Lawton & Wanska, 1977). This issue of effectiveness has been further complicated by research which places emphasis on a particular aid per se, rather than on the process by which the aid works. Text-learning research of this sort has "relentlessly sought individual methods of increasing retention, while bypassing understanding of the nature of the mental activity involved" (McConkie, 1978, p. 38).

There are at least three reasons why organizational aids sometimes fail to have a discernable effect on text recall. First, assessment is usually restricted to reproductive or rote learning outcomes. If the single function of an organizational aid is to reduce the burden on memory by means of the superordinate categories (subsuming concepts) it provides, then a reproductive emphasis is appropriate; however, if, as the assimilation encoding theory suggests, organization is an active process by which learners assimilate and organize new material to fit with their existing knowledge structures (Mayer, 1977), then productive or elaborative learning consequences should receive equal attention.

Second, the organizational aid may fail to enhance reproductive or productive learning outcomes because the second condition of meaningful learning is not satisfied -- a relevant assimilatory context is not activated. When an organizational aid is constructed by the experimenter (or instructor) there is no assurance that the aid actually will be used by learners to connect new material with their existing, related knowledge. Third, it is often assumed that the nature of conditions at the time of test (retrieval) does not matter, that is, the activation of a relevant context at encoding is sufficient to produce a long-enduring memory trace. This assumption ignores relevant orienting-task findings such as the following: "The retention levels associated with a particular type of encoding were not fixed, but depended heavily on the type of retrieval cue used" (Fisher & Craik, 1977, p. 709).

The present study was designed to assess the effects of assimilatory and retrieval contexts on the meaningful recall of text. Meaningful recall is comprised of both reproductive and productive text-learning outcomes. In formal educational settings, learners usually enter an instructional text with preconceptions, or expectations, about what the content of that text will be like. If accurate, these expectations may help learners prepare for meaningful text processing by ensuring that relevant stores of referential knowledge are activated. Thus, in the present study, it was reasoned that meaningful recall would be better if the context activated prior to text study was relevant rather than irrelevant to the content of the text. The experimenter provided a part of the assimilatory context: an outline depicting the text topics and the hierarchical relations existing among those topics. The other part of this assimilatory context was provided by the learners themselves: they generated

propositions about each of the topics in order to activate or engage the organizational aid. A hierarchically structured outline was chosen to be the organizational aid because this particular device is used frequently in classrooms; however, other means, such as a written overview, could have been used to make organizational cues available to learners.

It was expected that the meaningful recall of text would be greatest when cues were available at retrieval that could reactivate the relevant assimilatory context. Underlying this prediction was the principle of encoding specificity: "Specific encoding operations performed on what is perceived determine what is stored, and what is stored determines what retrieval cues are effective in providing access to what is stored" (Tulving & Thomson, 1973, p. 369). Consistent with the present emphasis on meaningful rather than rote recall, this principle was extended somewhat to encompass productive learning outcomes which result from the interaction of new, incoming information with that already present in learners' stores of referential knowledge (see Tulving, 1979).

With the passage of time, new information is assimilated into existing knowledge stores and, as a result, may lose its distinctiveness (Ausubel, 1960; Ausubel, Novak, & Hanesian, 1979). For this reason, it was anticipated that organizational cues would have a greater impact on long-term recall than immediate recall. Accordingly, recall was assessed immediately after text study and again after an interval of six weeks had elapsed.

Method

Subjects and Design

Participants were 44 (24 females and 20 males) undergraduate students solicited from several sections of the introductory educational psychology

course of a large state university. Four experimental groups were formed by orthogonally combining two factors: assimilatory context (relevant cues activated vs. irrelevant cues activated) and retrieval context (relevant cues available vs. no cues available). At retrieval, subjects received no cues instead of irrelevant cues because the presence of the latter might have induced subjects (contrary to their instructions) to include text-irrelevant content in their recall. Reproductive and productive learning outcomes were assessed immediately after text study and again six weeks later.

Materials

Text. The topics of the text were 15 concepts selected from Bower, Clark, Lesgold, and Winsenz's (1969) hierarchy of minerals. The concepts in this hierarchy branched from one another in a logical, that is, class-inclusive sequence. Four levels of organization were represented in the hierarchical structure of the text. At Level 1 the single topic was minerals. Level 2 topics were metals and stones. The four topics at Level 3 were rare metals, alloys, gem stones, and masonry stones. The eight topics at Level 4 included gold, silver, steel, brass, diamond, ruby, granite and marble.

These 15 topic names were paired with three attribute categories in a matrix of mineral information (see Glynn & Di Vesta, 1977, 1979). The three attributes of the matrix were the characteristic physical properties, modes of processing, and past and present uses of the minerals. The matrix (with data extracted from the Encyclopedia Americana, 1972) was used to construct three informative sentences (propositions) about each of the 15 mineral topics. In the construction of sentences, a subjective attempt was made to employ information that would be somewhat novel yet easily comprehended by the subjects.

In its final form, the text consisted of 15 three-sentence paragraphs, each devoted to one of the topics. Topic names were underlined to ensure their identification by readers. The following paragraph about brass is an example drawn from the text:

> Brass can be produced by combining zinc and copper. In a process called casting, molten brass assumes the shape of the container into which it is poured. Brass is often used to make musical instruments.

When the format of text topics reflects a high degree of organization, often the provision of cues is redundant because the topics and their interrelationships can be easily extracted from the text itself (for a detailed discussion see Mayer, 1978). For this reason, the inherent hierarchical organization of the text was rendered less apparent by randomizing the order of the 15 independent paragraphs. As a result, superordinate topics did not necessarily proceed subordinate topics, and categorically related topics were not necessarily adjacent to one another.

Structural outlines. The minerals structural outline identified the central concepts around which the minerals text was organized. The outline depicted 15 mineral topics and their inherent hierarchial relations. Superordinate topics subsumed subordinate topics and categorically related topics were in close spatial proximity. The minerals structural outline was as follows:

MINERALS

I. Metals
   A. Rare metals
      Silver
      Gold
   B. Alloys
      Steel
      Brass

II. Stones
   A. Gem stones
      Diamond
      Ruby
   B. Masonry stones
      Granite
      Marble

If the expectations that learners form about the nature of text content are less than accurate, then irrelevant stores of knowledge could be activated. To induce such expectations, subjects were provided with an animals structural outline which contained 15 concepts that were unrelated to those in the minerals text. The format of this outline paralleled that of the minerals structural outline in order to control learning-to-learn and warm-up behaviors. The animals structural outline was as follows:

ANIMALS

I. Mammals
   A. Land Mammals
      Fox
      Bear
   B. Water Mammals
      Dolphin
      Whale

II. Reptiles
   A. Snakes
      Cobra
      Rattlesnake
   B. Lizards
      Gila Monster
      Iguana

Procedure

Assimilatory context. Four subjects participated in each one-hour session; each subject was randomly assigned to one of the four experimental conditions. One-half of the subjects were presented the minerals structural outline, while the other one-half received the animals structural outline.

An outline was activated by requiring learners to generate three different propositions about each of the 15 topics depicted in the outline. All subjects received the following instructions:

> Study the outline you have been provided and generate in writing three accurate items of information (in the form of three short sentences) about each of the 15 topics. The first item should identify a physical characteristic of the topic, the second should describe how and where the topic is acquired, and the third should identify a way in which the topic is used.

After the information items had been generated and collected, all subjects were asked to read the minerals text. Prior to this time, no mention has been made of a text reading activity. The instructions concerning the text were:

> Each paragraph of this text deals exclusively with a particular mineral topic and several associated facts. Topic names have been underlined for you. Read the text carefully at your normal rate of speed and try to remember all of the facts associated with each of the topics. Although there is no limit on the time allowed to read the text, you are to read the text only once. When finished turn the text booklet over. The experimenter will then ask you to write down all of the information you can recall in any order you wish.

Retrieval context. Recall was assessed immediately after text reading and again six weeks later. At both recall periods, one-half of the subjects received a minerals structural outline with instructions to refer to it during recall; the other one-half of the subjects received no retr al aid.

In many memory experiments, recall instructions induce subjects to adopt a criterion of absolute accuracy (Cofer et al., 1976; Spiro, 1977). As a result, subjects "see it as their job to memorize the material, not to experience new knowledge" (Dooling & Christiaansen, 1977, p. 7). In the present study, recall instructions demanded approximate rather than absolute accuracy. In a sense, these instructions represented a compromise between instructions that require verbatim recall and instructions that encourage elaboration. At recall, all subjects were told:

> Write down in any order you wish all of the sentences you can recall from the text you read. Report your information in the form of sentences and not as isolated words. Try to be as exact as you can in your recall; however, if you think that you read a particular fact, but are not absolutely sure, report it anyway in sentence form and in your own words.

The recall period was twenty minutes.

Proposition Recall

In general, acceptable propositions were recalled statements which associated one of the 15 mineral topics with an item of information logically subsumed under one of the three attribute categories (physical characteristic, mode of processing, and use). An acceptable proposition was classified as either replicated, transposed, or elaborated. Inter-rater reliability coefficients on these three recall categories were .97, .98, and .94, respectively. Under all scoring procedures repetitions merited no additional score point.

Replicated proposition. As its name suggests, a replicated proposition was a reproductive learning outcome. This kind of proposition

linked a mineral topic name with its associated attribute item (value) as given in the text. For example, "Brass is often used to make musical instruments."

Transposed proposition. A transposed proposition was a productive learning outcome; it paired a mineral topic name with an attribute value that was orginally associated (in the text) with another topic name. For example, "Brass is applied to the surface of glass mirrors." The attribute value "glass mirrors" was originally paired with the topic "silver." Transposed propositions were reasonable if not always technically accurate.

Elaborated proposition. Another type of productive learning outcome was the elaborated proposition. For example, "Brass is used to make table lamps." "Table lamps" is an attribute value which is logically subsumed under the category of use; however, this value was not among those discussed in the text. Hence, it is an importation based on the interaction of the text and the learner's referential knowledge.

Results

A global analysis was conducted to assess the effects of the assimilatory and retrieval contexts on immediate and long-term meaningful recall. Next, conceptual clustering scores were analyzed to determine if the assimilatory and the retrieval contexts exerted influences on the organizational structure of recall. Finally, two analyses were performed exclusively on elaborated propositions (importations) in order to acquire information about their origin. The data of five subjects who were unable to return for a second session six weeks later were excluded from all analyses.

Meaningful Recall

Mean recall scores are presented in Table 1. An analysis of variance was performed which consisted of two between-subjects factors, assimilatory

---

Insert Table 1 about here

---

context and retrieval context, and two within-subjects factors, retention interval and type of proposition recalled. All main effects were significant. Thus, total meaningful recall was higher when: relevant ($\underline{M}$ = 26.53) rather than irrelevant ($\underline{M}$ = 18.93) cues were activated prior to reading, $F(1, 35) = 9.12$, $\underline{p} < .01$, $MS_e = 10.22$; relevant cues were available ($\underline{M}$ = 27.14) rather than unavailable ($\underline{M}$ = 18.32) at retrieval, $\underline{F}(1, 35) = 12.29$, $\underline{p} < .001$, $MS_e = 10.22$; and recall was immediate ($\underline{M}$ = 13.69) rather than six weeks later ($\underline{M}$ = 9.04), $\underline{F}(1, 35) = 25.01$, $\underline{p} < .001$, $MS_e = 5.57$. The recall of replicated propositions, considered alone, was also higher when: relevant cues were activated prior to reading, relevant cues were available at retrieval, and recall was immediate (see Table 1); however, only the effect of retention interval was statistically significant, $\underline{F}(1, 35) = 104.49$, $\underline{p} < .001$, $MS_e = 7.06$.

The main effects and that of a Retrieval Context x Retention Interval interaction, $\underline{F}(1, 35) = 13.58$, $\underline{p} < .001$, $MS_e = 5.57$, were qualified by a reliable Assimilatory Context x Retrieval Context x Retention Interval interaction, $\underline{F}(1, 35) = 6.11$, $\underline{p} < .01$, $MS_e = 5.57$. Newman-Keuls tests ($\underline{p} < .05$) indicated that retrieval context had no significant effect immediately after text study; however, six weeks later, it was clear that the availability of relevant cues at retrieval facilitated total meaningful recall. Futhermore, these cues were most effective when they had been

activated earlier, in advance of text study (see Table 1).

A significant main effect was also secured for the type of proposition recalled, $F(2, 70) = 26.59$, $p < .001$, $MS_e = 8.23$, with replicated propositions ($M = 11.45$) being recalled better than transposed ($M = 5.44$) and elaborated ($M = 5.84$) propositions. This effect and that of a Retention Interval x Type of Proposition Recalled interaction, $F(2, 70) = 71.12$, $p < .001$, $MS_e = 4.45$, were interpreted in light of a reliable Retrieval Context x Retention Interval x Type of Proposition Recalled interaction, $F(2, 70) = 5.69$, $p < .01$, $MS_e = 4.45$. Newman-Keuls tests revealed that the immediate recall of replicated propositions exceeded that of transposed and elaborated propositions; however, six weeks later, replicated propositions were found to have lost their recall advantage. In fact, a reversal occurred -- when relevant cues were available, the recall of transposed and elaborated propositions exceeded that of replicated propositions (see Table 2).

Insert Table 2 about here

Conceptual Organization of Recall

Total meaningful recall was better when (1) relevant rather than irrelevant cues were active before study and (2) relevant cues were available rather than unavailable at retrieval. If these cues did, in fact, influence recall by means of organizational processes, then subjects' protocols should contain ideational patterns which reflect this influence.

All recalled propositions (with the exception of those about the introductory topic "minerals") were classifiable under two branches of the minerals hierarchy: metals and stones. That is, the replicated, transposed,

and elaborated propositions that were reported were either about metals and metal-related topics (e.g., rare metals, gold, silver, and platinum), or about stones and stone-related topics (e.g., gem stones, diamond, ruby, and emerald). By means of Roenker, Thompson, and Brown's (1971) Adjusted Ratio of Clustering (ARC) formula, scores were computed which served as indices of organization. The ARC formula assigns chance clustering a score of zero and perfect clustering a score of one. A subject's protocol received a maximum score of one when all metal-related propositions were reported in an unbroken sequence, and all stone-related propositions were reported in another unbroken sequence. The recalled propositions about the introductory topic minerals were excluded from this analysis because they could not be assigned to one of the two major clusters.

An analysis of variance was performed on these ARC scores to determine the effects of assimilatory context, retrieval context, and retention interval. Retrieval context produced a significant main effect, $F(1, 35) = 60.24$, $p < .001$, $MS_e = .10$, which indicated that clustering was higher with relevant cues ($M = .88$) than without them ($M = .32$). In addition, the Assimilatory Context x Retrieval Context interaction was significant, $F(1, 35) = 5.45$, $p < .05$, $MS_e = .10$. Newman-Keuls tests indicated that the activation of a relevant assimilatory context (in the absence of retrieval cues) exerted the following influence on organizational behavior: Without retrieval cues, clustering was higher when a relevant ($M = .44$) rather than irrelevant ($M = .21$) assimilatory context had been activated. When retrieval cues were present, clustering was very high, and roughly equivalent, regardless of whether the assimilatory context was relevant ($M = .83$) or irrelevant ($M = .94$). The slight advantage of the irrelevant over the relevant assimilatory context, while not significant, was unexpected. This

discrepancy prompted a closer inspection of the protocols that were produced when retrieval cues were available. The inspection revealed that subjects generated two largely homogenous clusters of propositions: one comprised of metal-related propositions and the other of stone-related propositions. Some subjects, most of whom were in the relevant assimilatory-context condition, followed their production of two major clusters with a few randomly ordered propositions. The inclusion of these later propositions (perhaps "afterthoughts") lowered their clustering scores somewhat.

Elaboration at Recall

When the relevant assimilatory context was activated, subjects generated mineral-related propositions in advance of text study. Subjects later included some of these assimilatory-context propositions in their recall protocols. As a result, immediate recall included two categories of elaborated proposition: (1) old (repeated) propositions that were generated when the relevant assimilatory context was activated, and (2) new propositions that were constructed during immediate recall. Six-week recall, on the other hand, included three categories of elaborated proposition: (1) old (repeated) propositions from the assimilatory context, (2) old (repeated) propositions from the immediate recall, and (3) new propositions that were constructed during six-week recall. Mean scores in each category of elaborated proposition are presented in Table 3.

Insert Table 3 about here

Understandably, subjects who generated animal-related propositions when an irrelevant assimilatory context was activated did not report any of these irrelevant propositions when they recalled the minerals text.

Hence, no entries appear in Table 3 under the category of old propositions from the irrelevant assimilatory context.

Construction of new elaborated propositions. The analysis of meaningful recall indicated that the availability of relevant cues at retrieval enhanced the recall of elaborated propositions six weeks after text study. It is important to note that some of these elaborated propositions were not constructed at the time of six-week recall; some propositions were constructed earlier (either during activation of the assimilatory context or during immediate recall) and then repeated at the time of six-week recall. Therefore, in order to accurately assess the effects of organizational cues on the construction (rather than repetition) of elaborated propositions, an analysis of variance was conducted on new elaborated propositions only. Those propositions repeated from the assimilatory context were excluded from this analysis. Likewise, propositions constructed during immediate recall were not credited a second time if they were repeated six weeks later. The analysis included three factors: assimilatory context, retrieval context, and retention interval.

A significant main effect for retrieval context, $F(1, 35) = 6.49$, $p < .01$, $MS_e = 7.32$, indicated that the construction of new elaborated propositions was greater when relevant cues were available ($M = 6.29$) than unavailable ($M = 3.16$). In addition, a reliable Retrieval Context x Retention Interval interaction, $F(1, 35) = 9.65$, $p < .01$, $MS_e = 2.61$, was obtained. Newman-Keuls tests supported the following observations: without retrieval cues, construction of new elaborated propositions decreased from immediate to six-week recall; however, with retrieval cues, construction increased from immediate to six-week recall (see Table 3).

Repetition of old, assimilatory-context propositions. When relevant assimilatory cues were activated, propositions about mineral topics were generated by subjects on the basis of their existing knowledge. In order to determine how often these assimilatory-context propositions were repeated during immediate and six-week recall, an analysis of variance was performed which consisted of two factors: retrieval context and retention interval.

Retention interval produced a significant main effect, $F(1, 18) = 7.69$, $p < .01$, $MS_e = .56$, with more propositions from the relevant assimilatory context being repeated six weeks after text study ($M = 1.12$) than immediately after text study ($M = .46$). This effect was qualified by a reliable Retrieval Context x Retention Interval interaction, $F(1, 18) = 13.73$, $p < .01$, $MS_e = .56$. Thus, during immediate recall, the repetition of propositions from the relevant assimilatory context was unaffected by the availability ($M = .36$) or unavailability ($M = .56$) of relevant retrieval cues; however, six weeks later, the repetition of these propositions was greater with retrieval cues ($M = 1.91$) than without them ($M = .33$). Since retrieval cues were more effective six weeks after text study than immediately afterwards, it seems likely that these propositions were supressed by a factor whose influence dissipated somewhat over the course of time.

Discussion

Outside of the laboratory, it is rare for learners to enter an instructional text without any preconceptions, or expectations, about what the content of that text will be like. In most classroom settings, there are demand characteristics (e.g., teacher's remarks, text titles, or prior

topic coverage) operating that induce such expectations. On the basis of these expectations, learners activate stores of referential knowledge.

Expectations that learners have about the nature of text content can be used to prepare for meaningful processing. Specifically, these expectations can identify certain superordinate concepts, or cues, that can help learners to compartmentalize text content and integrate it with existing knowledge (Ausubel et al., 1979; Mayer, 1977). It is clear that the accuracy of the learners' expectations determines the relevance of these cues to the task at hand. For this reason, total meaningful recall is better when encoding cues are relevant rather than irrelevant.

At retrieval, relevant cues help learners gain access to text related stores of existing knowledge (Glynn & Di Vesta, 1977). As a consequence, total meaningful recall is better with these cues than without them. Although cue manipulations either at encoding or at retrieval have strong effects on total meaningful recall, the combinatorial effect of encoding and retrieval cues working together has an even greater impact. In fact, total meaningful recall is best when the relevant cues operating at encoding are reactivated, or reinstated, at the time of retrieval. This combinatorial effect is generally consistent with the following view:

> Greater degrees of elaboration at input lead to the formation of a more distinctive trace; since this distinctiveness is relative to a particular context or encoding dimension, this dimension must be reinstated at retrieval. Also at retrieval, information provided by the retrieval cue is elaborated by "reconstructive processes" to a greater or lesser degree depending on task demands. (Jacoby & Craik, 1979, p. 19)

Ideational patterns that are present in recall also suggest that cues can help learners to structure text content and intergrate it with existing knowledge. For example, propositions are clustered into conceptual categories more readily when the cues active at encoding are relevant instead of irrelevant. Likewise, conceptual clustering is more pronounced when relevant cues are made available at retrieval.

Considerable interest exists in "discovering what manipulations can increase the amount of relevant elaborative processing that a student can do for prose material" (Anderson & Reder, 1979, p. 401). One way to stimulate elaboration is to ensure that relevant organizational cues are available to learners at retrieval. Since elaboration is better when these cues are present, it is clear that organizational activity does more than prompt the recall of text content. Organizational activity can stimulate legitimate transactions between what learners already know and what they are setting out to learn. These transactions enrich meaningful recall.

Relevant retrieval cues stimulate more elaboration six weeks after text study than immediately afterwards. One explanation for this outcome is that learners edit their immediate reports in order to preserve the integrity of text content (Cofer et al., 1976; Spiro, 1977). An editorial set could be the result of prior testing experiences in school settings where students are often reinforced for rote recall and penalized for elaboration. Although teachers do not willfully induce students to process information in a rote fashion, students may, nevertheless, adopt a rote learning strategy in order to complement a strict criterion of assessment (Levin, Ghatala, & Truman, 1979). Effective editing by learners probably requires that they "tag" (by means of recency) text propositions during study. These tags distinguish text propositions from

related propositions that are present in learners' existing knowledge stores. With the passage of time, these tags may lose effectiveness causing the boundaries among existing information, text information, and elaborated information to become less distinct. As a result, the elaborative effects of cues are more pronounced during long-term recall than during immediate recall.

An apparent increment in meaningful recall that occurs over a retention interval of at least several days (without any intervening practice) has been traditionally termed "reminiscence" (Ballard, 1913; Williams, 1926). The effect is probably an artifact; when it occurs, the material to be recalled is usually partially learned discourse. At least two explanations for the reminiscence effect are popular: (1) the immediate recall activity provides learners with practice which facilitates their delayed recall, and (2) the learners engage in rehearsal over the retention interval which facilitates their delayed recall (see Travers, 1977).

A phenomenon similar to reminiscence is exhibited when learners generate relevant propositions in advance of text study: namely, the propositions that comprise the relevant assimilatory context are repeated more often during long-term recall than during immediate recall. However, in order for this reminiscence-like effect to occur, relevant organizational cues must be available at retrieval. Thus, it appears as though these reminiscential assimilatory-context propositions share the same fate as newly constructed elaborations. Both classes of proposition represent extratextual extensions of meaning, and both are initially suppressed (censored) by learners in order to preserve the integrity of text content. During long-term recall, censorship is reduced and the priming effects of relevant retrieval cues on both classes of proposition become apparent.

In conclusion, several recommendations can be made for instructional practice. When a text is processed meaningfully, students will construct elaborations that are based partly on text content and partly on their relevant existing knowledge. Some of these elaborations may not be entirely accurate; however, it is only reasonable to expect some misinterpretations to occur when students make decisions about how text information complements their own existing knowledge. In most cases, the benefits derived from the generation of new knowledge will far outweigh the disadvantages associated with occasional misinterpretations.

In order to ensure that text learning is meaningful instead of rote, teachers must control the demand characteristics of the classroom learning situation -- that is, they must control the contexts in which text content is acquired and retrieved. One means of control is to build knowledge contexts around organizational aids such as outlines. Students can then use these aids to gain access to appropriate memorial stores.

References

Anderson, J. R., & Reder, L. M. An elaborative processing explanation of depth of processing. In L. S. Cermak and F. I. M. Craik (Eds.), Levels of processing in human memory, Hillsdale, N. J.: Lawrence Erlbaum Associates, 1979.

Anderson, R. C., Reynolds, R. E., Schallert, D. L., & Goetz, E. G. Frameworks for comprehending discourse. American Educational Research Journal, 1977, 14, 367-381.

Ausubel, D. P. The use of advance organizers in the learning and retention of meaningful verbal material. Journal of Educational Psychology, 1960, 51, 267-272.

Ausubel, D. P., Novak, J. P., & Hanesian, H. Educational psychology: A cognitive view (2nd ed.). New York: Holt, Rinehart & Winston, 1978.

Ballard, P. B. Oblivescence and reminiscence. British Journal of Psychology, Monograph Supplements, 1913, 1, No. 2.

Bower, G. H., Clark, M. C., Lesgold, A. M., & Winzenz, D. Hierarchical retrieval schemes in recall of categorized word lists. Journal of Verbal Learning and Verbal Behavior, 1969, 8, 323-343.

Christensen, C. M., & Stordahl, K. E. The effects of organizational aids on comprehension and retention. Journal of Educational Psychology, 1955, 46, 65-74.

Cofer, C. N., Chmielewski, D. L., & Brockway, J. F. Cognitive processes and the structure of human memory. In C. N. Cofer (Ed.), The structure of human memory. San Francisco: Freeman, 1976.

Dooling, D. J., & Christiaansen, R. E. Levels of encoding and retention of prose. In G. H. Bower (Ed.), The psychology of learning and motivation (Vol. 12). New York: Academic Press, 1977.

Fisher, R. P., & Craik, F. I. M. The interaction between encoding and retrieval operations in cued recall. Journal of Experimental Psychology: Human Learning and Memory, 1977, 3, 701-711.

Frase, L. T. Paragraph organization of written materials: The influence of conceptual clustering upon the level and organization of recall. Journal of Educational Psychology, 1969, 60, 394-401.

Glynn, S. M., & Di Vesta, F. J. Outline and hierarchical organization as aids for study and retrieval. Journal of Educational Psychology, 1977, 69, 89-95.

Glynn, S. M., & Di Vesta, F. J. Control of prose processing via instructional and typographical cues. Journal of Educational Psychology, 1979, 71, 595-603.

Gomulicki, B. R. Recall as an abstractive process. Acta Psychologica, 1956, 12, 77-94.

Hartley, J., & Davies, I. K. Preinstructional strategies: The role of pretests, behavioral objectives, overviews, and advance organizers. Review of Educational Psychology, 1976, 46, 239-265.

Howe, M. I. A. Repeated presentation and recall of meaningful prose. Journal of Educational Psychology, 1970, 61, 214-219.

Lawton, J. T., & Wanska, S. K. Advance organizers as a teaching strategy: A reply to Barnes & Clawson. Review of Educational Research, 1977, 47, 233-244.

Levin, J. R., Ghatala, E. S., & Truman, D. L. Reducing intersentence interference via contextual aids. American Educational Research Journal, 1979, 16, 249-256.

Mayer, R. E. Different problem-solving competencies established in learning computer programming with and without meaningful models. Journal of Educational Psychology, 1975, 67, 725-734.

Mayer, R. E. Some conditions of meaningful learning of computer programming: Advance organizers and subject control of frame sequencing. Journal of Educational Psychology, 1976, 68, 143-150.

Mayer, R. E. The sequencing of instruction and the concept of assimilation-to-schema. Instructional Science, 1977, 6, 369-388.

Mayer, R. E. Advance organizers that compensate for the organization of text. Journal of Educational Psychology, 1978, 70, 880-886.

McConkie, G. W. Learning from text. In Lee S. Shulman (Ed.), Review of Research in Education, (Vol. 5), Itasca, Illinois: Peacock Publishers.

Merrill, M. D. & Stolurow, L. M. Hierarchical preview vs. problem oriented review in learning an imaginary science. American Educational Research Journal, 1966, 3, 251-261.

Roenker, D. L., Thompson, C. P., & Brown, S. C. Comparison of measures for the estimation of clustering in free recall. Psychological Bulletin, 1971, 76, 45-48.

Spiro, R. J. Remembering information from text: The "state of schema" approach. In R. C. Anderson, R. J. Spiro, & W. E. Montague (Eds.), Schooling and the acquisition of knowledge. Hillsdale, N. J.: Lawrence Erlbaum Asscciates, 1977.

Travers, R. M. W. Essentials of learning. (4th Ed.) New York: MacMillan, 1977.

Tulving, E. Relation between encoding specificity and levels of processing. In L. S. Cermak and F. I. M. Craik (Eds.), Levels of processing in human memory, Hillsdale, N. J.: Lawrence Erlbaum Associates, 1979.

Tulving, E., & Thomson, D. M. Encoding specificity and retrieval processes in episodic memory. Psychological Review, 1973, 80, 352-373.

Williams, O. A study of the phenomenon of reminiscence. Journal of Experimental Psychology, 1926, 9, 368-389.

Zangwill, O. L. Remembering revisited. Quarterly Journal of Experimental Psychology, 1972, 24, 123-138.